

**TECHNICAL BACKGROUND DOCUMENT  
FOR THE REPORT TO CONGRESS  
ON REMAINING WASTES  
FROM FOSSIL FUEL COMBUSTION:  
EXISTING STATE REGULATORY CONTROLS**

**March 15, 1999**

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## 1.0 METHODOLOGY

This report characterizes state solid and hazardous waste regulations for industries generating remaining fossil fuel combustion (FFC) wastes. The analysis focused on state implementation of solid waste controls on FFC wastes under Subtitle D of the federal Resource Conservation and Recovery Act (RCRA). State solid waste management regulations were analyzed first on a nationwide scale, using survey data for all 50 states, and second on a more detailed level, using case studies of selected states.

For analysis on a nationwide scale, data on state solid waste management regulations in all 50 states were compiled from four sources:

- Association of State and Territorial Solid Waste Management Officials (ASTSWMO) Non-municipal, Subtitle D Survey (ASTSWMO, 1995): In January 1995, ASTSWMO initiated a survey of state and territorial waste management programs regarding regulatory programs for management of nonmunicipal (i.e., industrial) solid waste. Fifty of 56 states and territories responded to the survey.
- EPA's State Requirements for Industrial Non-Hazardous Waste Management Facilities (EPA, 1995): In October 1995, EPA conducted a paper review of statutes and regulations, as published in the Bureau of National Affairs (BNA) *Environmental Reporter*, in all 50 states covering design and operation of waste management units. EPA then summarized the requirements, supplementing the analysis with descriptive information from a Chemical Manufacturers Association report and an 1987 EPA survey. The statutes and regulations reviewed were current as of August 1994. EPA did not contact state representatives to verify the obtained information.
- Council of Industrial Boilers (CIBO) Survey of State Waste Management Controls (CIBO, 1997): In 1997, as part of its report on FBC waste, CIBO conducted a survey of state disposal regulations pertinent to FFC wastes, and coal combustion wastes (CCWs) in particular. Thirty of 56 states and territories responded to the survey. These states accounted for approximately 70 percent of total coal combustion in 1995.
- American Coal Ash Association (ACAA) State-by-State Summaries of Solid Waste Regulations (ACAA, 1996): In 1996, ACAA reviewed and summarized state solid waste regulations governing the use of coal combustion byproducts in all 50 states.

The ACAA summaries were used to characterize the exemption status of FFC wastes in all 50 states. The ASTSWMO and CIBO survey results were combined to characterize the types of regulatory controls imposed on FFC waste management units. The EPA review data were used to describe daily cover/fugitive

dust controls (which were not surveyed by ASTSWMO), to confirm the other survey data for the states with the largest capacity in each generating sector, and to provide additional descriptive information.

The ASTSWMO and CIBO results agreed in the majority of cases. Where the two sources disagreed, the ASTSWMO data were used because the results were more detailed and better documented. The analysis then used the combined data to generate summary statistics on the nature and stringency of state solid waste management controls in all 50 states. In the case of CCWs, these data also were compared to historical data from the 1988 Report to Congress to draw conclusions about trends in state regulation.

To further characterize state implementation, EPA examined, in detail, programs in several (two to five) selected states for each FFC waste sector. The specific states were selected to maximize the percentage of generating capacity covered in each sector while making efficient use of available resources. For example, much of the regulatory controls information was collected during visits to state agencies to collect waste management and damage case information. The analysis of each state included review of regulations, discussions with state officials, comparison with observed management practices, and review of published summary information, including that in the CIBO report and the survey publications cited above.

## **2.0 COMANAGED WASTES AT COAL-FIRED UTILITIES**

EPA regulates the management of solid and hazardous waste through Subtitles C and D of the federal RCRA. Subtitle C establishes a “cradle-to-grave” management system for wastes that are considered hazardous because they fail tests based on their physical and chemical characteristics (i.e., toxicity, corrosivity, ignitability, and reactivity) or because they are listed as hazardous by EPA. Federal regulations establish stringent environmental and administrative controls that must be applied to management of these wastes. Comanaged utility coal-fired wastes currently are exempt from federal regulation as hazardous waste under Subtitle C pending this Report to Congress and the subsequent regulatory determination. Therefore, these wastes are subject to the requirements of Subtitle D of RCRA as nonhazardous solid waste.

### **2.1 NATIONWIDE CHARACTERIZATION OF STATE REGULATIONS**

Implementation of Subtitle D is the responsibility of individual states, but nothing prevents states from imposing more stringent requirements (including hazardous waste requirements) on FFC wastes. Currently, 44 states (representing 96 percent of utility coal-fired generating capacity) duplicate the federal policy exempting CCWs from hazardous waste regulations. The other six states (Kentucky, Tennessee, Washington, New Jersey, Maine, and California) do not exempt CCWs from hazardous waste regulation. In these states, any CCWs that fail the hazardous waste characteristic tests would be subject to state hazardous waste requirements and managed in units that meet permitting, design, operating, corrective action, and closure standards. EPA believes that these standards, because they must be at least as stringent as the federal standards under RCRA Subtitle C, are sufficient to mitigate risks from these wastes.

CCWs, however, rarely fail the hazardous waste characteristic tests. Therefore, the majority of CCWs that do not fail the hazardous waste characteristic tests and/or are generated in the 44 states that duplicate the federal exemption generally would be subject to less stringent state requirements under Subtitle D. The 1988 Report to Congress presented data on such state regulations from a 1983 Utility Solid Waste Activities Group (USWAG) survey. Under 1983 regulations, most states required permits for landfills managing CCWs, at least on a case-by-case basis. However, a smaller percentage of states had the authority to impose physical controls or monitoring requirements on these landfills (see Table 2-1). The 1988 Report to Congress also found that state regulations only “indirectly addressed” waste management in surface impoundments.

**Table 2-1. State Regulatory Controls on CCW Landfills**

	1988 Report to Congress			Current		
	Number of States <sup>b</sup>	Percent of States <sup>c</sup>	Percent of Capacity <sup>d</sup>	Number of States <sup>b</sup>	Percent of States <sup>c</sup>	Percent of Capacity <sup>d</sup>
Hazardous Waste Exemption <sup>a</sup>	43	86%	88%	44	88%	96%
Permit Onsite	41	82%	75%	41	82%	77%
Permit Offsite	49	98%	94%	48	96%	95%
Siting Controls	30	60%	54%	46	96%	92%
Liner	11	22%	24%	43	86%	87%
Leachate Collection	20	40%	31%	42	84%	79%
Ground-Water Monitoring	28	56%	60%	46	92%	89%
Closure	27	54%	59%	45	90%	91%
Cover and/or Dust Controls	Not surveyed			49	98%	96%
<sup>a</sup> Exemption from state hazardous waste regulations for CCWs						
<sup>b</sup> Number of states with authority to impose the indicated requirement, either by regulation or on a case-by-case basis						
<sup>c</sup> Percent of surveyed states with authority						
<sup>d</sup> Percent of surveyed utility generating capacity represented by states with authority						
Sources: USWAG, 1983; CIBO, 1997; ASTSWMO, 1995; EPA, 1995; ACAA, 1996						

More recent data show that the majority of states now have authority to impose physical controls and monitoring requirements on CCW landfills, at least on a case-by-case basis. Table 2-1 compares state regulatory authority with respect to CCW landfills reported in the 1988 Report to Congress to current data. For surface impoundments, the percentage of states with authority is similar to that for landfills. Table 2-2 shows data on current state regulatory authority with respect to surface impoundments.

The data in Tables 2-1 and 2-2 show that states increasingly have become able to impose controls on CCW management units. In addition to regulatory permits, the majority of states are now able to require siting controls, liners, leachate collection systems, ground-water monitoring, closure controls, daily (or other operational) cover, and fugitive dust controls. EPA believes that the use of such controls has the potential to mitigate risks, particularly ground-water pathway risks, from comanaged waste disposal. The sufficiency of this mitigation depends on the extent to which states are exercising their authority in situations in which climate, geology, site-specific conditions, and waste characteristics justify it.

Based on data collected for the Remaining Waste Report to Congress, nearly all of the active CCW comanagement landfills surveyed are subject to regulatory permits and ground-water monitoring requirements. Just more than half of the surveyed landfills are lined and just less than half have leachate

**Table 2-2. Current State Regulatory Controls on CCW Surface Impoundments**

	Number of States <sup>b</sup>	Percent of States <sup>c</sup>	Percent of Capacity <sup>d</sup>
Hazardous Waste Exemption <sup>a</sup>	44	88%	96%
Permit Onsite	45	92%	87%
Permit Offsite	45	94%	88%
Siting Controls	41	87%	81%
Liner	45	92%	91%
Leachate Collection	33	73%	68%
Ground-Water Monitoring	44	96%	94%
Closure	43	91%	88%
<sup>a</sup> Exemption from state hazardous waste regulations for CCWs <sup>b</sup> Number of states with authority to impose the indicated requirement, either by regulation or on a case-by-case basis <sup>c</sup> Percent of surveyed states with authority <sup>d</sup> Percent of surveyed utility generating capacity represented by states with authority Sources: CIBO, 1997; ASTSWMO, 1995; ACAA, 1996			

collection systems. A lesser percentage of active CCW comanagement surface impoundments have similar controls. These statistics suggest that states have exercised their authority to impose control at landfills, and to a lesser extent at surface impoundments. Furthermore, the data show increasing trends in the use of liners and ground-water monitoring at newer units, both landfills and surface impoundments. This finding suggests that states are increasingly applying their regulatory authority as new units are introduced.

## 2.2 CASE STUDIES OF STATE REGULATIONS

To further examine state implementation of solid waste requirements on utility CCWs, EPA examined in greater detail the regulations applicable in five states: Indiana, Pennsylvania, North Carolina, Wisconsin, and Virginia. These five states account for almost 20 percent of coal-fired utility electrical generating capacity.

### Indiana

Indiana classifies the four large-volume CCWs (and other industrial wastes) as restricted wastes and has developed a specific regulatory program for these wastes. In most cases, the chemical characteristics of restricted wastes must be analyzed using the Toxicity Characteristic Leaching Procedure (TCLP) prior to disposal. The results of this analysis dictate the type of facility in which the waste may be disposed.



Indiana regulations classify restricted waste landfills into four categories: Type I, Type II, Type III, or Type IV. Type I landfills are permitted to receive restricted wastes that leach the highest levels of constituents of concern. TCLP analysis of CCWs disposed in Type I landfills is not required. Type II and Type III landfills receive intermediate wastes that leach lower levels. Type IV landfills receive wastes that leach the lowest levels of constituents of concern. In addition, restricted waste disposal facilities are subject to design, operating, and closure requirements that vary in stringency according to their type. Table 2-3 describes the acceptable waste limitations and relevant requirements for each type of facility. Leachate collection systems are not required, but may be used in some cases to relax the liner thickness requirements. Indiana's restricted waste requirements have been in effect since September, 1989; facilities that existed prior to that date may continue to operate, but any expansions at these facilities must comply with the newer regulations.

**Table 2-3. Indiana Restricted Waste Disposal Facility Requirements**

Facility Type	Acceptable Waste	Design, Operating, and Closure Requirements
Landfills		
Type I	Any restricted waste	Clay liner (thickness of 10 feet or more depending on permeability of the waste), siting restrictions, fugitive dust control, daily cover, soil erosion control, ground-water monitoring, 2-foot clay cap at closure, revegetation at closure
Type II	TCLP results less than 25 times the federal MCL	Clay liner (thickness of 5 to 10 feet depending on permeability of the waste), siting restrictions, fugitive dust control, daily cover, soil erosion control, ground-water monitoring, 2-foot clay cap at closure, revegetation at closure
Type III	TCLP results less than 10 times the federal MCL	Clay liner (thickness of 3 feet), siting restrictions, fugitive dust control, weekly cover, soil erosion control, 2-foot clay cap at closure, revegetation at closure
Type IV	TCLP results at the federal MCL	Siting restrictions

Indiana water regulations require permitting of surface impoundments, but do not impose any specific design requirements. Requirements may be imposed on a case-by-case basis in individual permits.

Indiana's requirements, when applied to utility CCW comanagement landfills, impose controls tailored to the characteristics of the individual waste streams comanaged. The available TCLP data for comanaged wastes indicate that these wastes typically have leachate concentrations between 1 and 10 times the federal MCLs. Samples from 9 percent of sites (1 of 11) showed selenium concentrations between 10 and 25 times the MCL. In samples from an additional 9 percent (1 of 11), the concentration was greater than 25 times

the MCL. Assuming comanaged wastes in Indiana display similar characteristics, these wastes would be amenable for disposal in Type III landfills, with Type I or II disposal required in only a few cases.

The Electric Power Research Institute's (EPRI) comanagement survey includes 11 active comanagement landfills and surface impoundments in Indiana. All of the units have state permits. Two are landfills opened in 1978 and 1981, respectively. Both have compacted clay liners. Data on the thickness of these liners are not available. Only the newer landfill conducts ground-water monitoring, and neither has a leachate collection system. Thus, environmental controls at these landfills appear consistent with at least the requirements for Type III landfills. The other nine units in Indiana are surface impoundments. Two impoundments (the newest one and one opened in 1959) have compacted clay liners; the others are unlined. None of them has a leachate collection system or conducts ground-water monitoring.

## **Pennsylvania**

Under Pennsylvania regulations, the four large-volume CCWs are exempt from regulation as hazardous waste. Pennsylvania classifies these and other industrial wastes as residual waste, and has developed a specific regulatory program for these wastes. Generators of residual waste must submit a bi-annual report to the Department of Environmental Protection (DEP) describing the quantity and disposition of waste generated. The chemical characteristics of residual wastes must be analyzed using the TCLP prior to disposal. The results of this analysis dictate the type of facility in which the waste may be disposed.

Pennsylvania regulations classify residual waste disposal facilities as Class I, II, or III landfills and Class I or II surface impoundments. Class I facilities are permitted to receive residual wastes that leach the highest levels of constituents of concern, while Class II and III facilities receive wastes that leach lower levels. All classes must be issued a permit by the DEP. In addition, residual waste disposal facilities are subject to design, operating, and closure requirements that vary in stringency according to their class. Table 2-4 describes the acceptable waste limitations and relevant requirements for each class. Storage impoundments (those that store waste for less than 1 year) are subject to design, operating, and closure requirements that are essentially the same as those for disposal impoundments.

The residual waste program described in Table 2-4 was promulgated on July 4, 1992. Units permitted prior to that date were subject to a transition program under which they were required to modify their operations to comply with the requirements by July 4, 1997. For these older units, DEP was allowed to

**Table 2-4. Pennsylvania Residual Waste Disposal Facility Requirements**

Facility Type	Acceptable Waste	Design, Operating, and Closure Requirements
Landfills		
Class I	Any nonhazardous waste	Two liners (at least one composite), leachate detection system, leachate collection system, fugitive dust control, daily cover, soil erosion control, ground-water monitoring, 2-foot clay cap at closure, revegetation at closure
Class II	TCLP results less than 50 times the federal MCL	Composite liner, leachate detection system, leachate collection system, fugitive dust control, daily cover, soil erosion control, ground-water monitoring, 2-foot clay cap at closure, revegetation at closure
Class III	TCLP results less than 25 times the federal MCL	4-foot attenuating soil base or 1 foot per 4 feet of waste, fugitive dust control, daily cover, soil erosion control, ground-water monitoring, 2-foot clay cap at closure, revegetation at closure
Surface Impoundments		
Class I	Any nonhazardous waste	Two liners (at least one composite), leachate detection system, leachate collection system, minimum freeboard requirements, structural integrity requirements, ground-water monitoring, 2-foot clay cap at closure, revegetation at closure
Class II	TCLP results less than 50 times the federal MCL	Composite liner, leachate detection system, leachate collection system, minimum freeboard requirements, structural integrity requirements, ground-water monitoring, 2-foot clay cap at closure, revegetation at closure

waive or modify the liner and leachate collection requirements if the operator could demonstrate that the unit had not caused unacceptable ground-water degradation or that remediation was under way to restore ground-water quality to acceptable levels.

Pennsylvania's residual waste regulations, therefore, impose controls tailored to the characteristics of the individual waste streams comanaged. The available TCLP data for comanaged wastes indicate that these wastes rarely have leachate concentrations greater than 25 times the federal MCL. Samples from only 9 percent of sites (1 of 11) showed selenium concentrations between 25 and 50 times the MCL. Assuming comanaged wastes in Pennsylvania display similar characteristics, these wastes would be amenable for disposal in Class III landfills, with Class II disposal required in only a few cases.

EPRI's comanagement survey includes nine active comanagement units in Pennsylvania. All are landfills opened prior to 1992 and have state permits. All nine conduct ground-water monitoring and indicated they have a soil or sand cap. One of the units has a single composite liner and a leachate collection system, suggesting that it is a Class II landfill. The other units have soil liners, compacted ash liners, or single geosynthetic liners. All but one of these have leachate collection systems. These controls suggest that

these other units are either Class III landfills or Class I or II landfills for which the liner requirements have been modified under the transition program. Thus, the available data confirm that comanagement units in the state have environmental controls consistent with the state's regulations.

In addition to disposal in landfills and surface impoundments, Pennsylvania's residual waste regulations also authorize the use of CCWs in minefills. These wastes may be used at mine sites as backfill, to improve soil productivity, to neutralize mine spoil acidity, or to create a layer of low permeability in backfilled spoil. These uses are subject to certification by the DEP. Certification requires that CCW meet the TCLP limits for disposal at a Class III landfill. The DEP may grant a contingent certification on a case-by-case basis if the waste exceeds the leachate concentration for aluminum, iron, manganese, sulfate, or zinc. Certification also requires that CCW meet pH guidelines when used as backfill or soil additive, have a minimum calcium carbonate content when used as a soil additive, and meet hydraulic conductivity limits when used as a low permeability material. Certification is re-evaluated every 6 months. DEP also requires ground-water monitoring at minefills.

The regulations also authorize the use of CCWs as a soil substitute or soil additive. Such uses do not require a permit or certification, but the user must notify the DEP. The CCWs must meet pH guidelines and the user must employ runoff and erosion controls. There also are siting limitations on such agricultural uses.

## **North Carolina**

In North Carolina, the four large-volume CCWs are exempt from regulation as hazardous waste and are regulated as industrial solid waste. Separate regulatory programs apply to landfills and surface impoundments managing these wastes.

Industrial solid waste landfills in North Carolina must obtain a permit from the Department of Environment, Health, and Natural Resources (DEHNR). As part of the permit process, all industrial waste landfills must demonstrate to DEHNR that their designs will ensure that the state ground-water standards are not exceeded at the compliance boundary. The design criteria for demonstrating this include a composite liner, leachate collection system, and cap at closure. Alternatively, the operator may submit ground-water modeling results that demonstrate, based on hydrologic and climatic conditions and waste characteristics, that the standards will be met. Landfills operating prior to October 1, 1995 (when the state

began implementing these rules) are not “grandfathered.” To continue operating after January 1, 1998, these units had to submit information to demonstrate that their original designs or proposed design changes would meet the ground-water standards. DEHNR has the authority to require design modifications if ground-water modeling methods or results are inadequate.

Surface impoundments are excluded from the state’s solid waste regulations and are governed by water quality regulations. Under these regulations, impoundments managing CCWs or other solid wastes must obtain a permit from DEHNR’s Division of Water Quality. Other than requiring a minimum level of freeboard, the water quality regulations do not dictate any specific design, operating, or ground-water monitoring requirements. Requirements may be imposed on a case-by-case basis in individual permits.

EPRI’s comanagement survey includes one active comanagement landfill in North Carolina. This state-permitted landfill opened in 1989. As of the date of the survey, the landfill conducted ground-water monitoring and had a compacted clay liner and a leachate collection system. To meet the current requirements, this landfill would have had to demonstrate the adequacy of these designs, undertake design modifications, or cease operating. The comanagement survey also includes 14 active comanagement surface impoundments. All of these units are unlined and state permitted. Only four of them monitor ground water.

DEHNR does not have specific requirements applicable to minefills. CCWs may be used for agricultural purposes under the authority of the North Carolina Department of Agriculture.

## **Wisconsin**

The four large-volume CCWs are exempt from regulation as hazardous wastes under Wisconsin regulations. These wastes are regulated as industrial solid waste under the state’s solid waste management regulations. The state requires permits for all onsite and offsite solid waste management facilities. All landfills must meet specific design and operating requirements.

New and expanded landfills for which the plan of operation was approved after July 1, 1996, must have clay or composite liners and leachate collection systems. Clay liners are required to be at least 5-feet thick. Composite liners must incorporate at least 4 feet of clay and a 60-mil geomembrane layer. All landfills are required to control fugitive dust. Landfill closure must include the application of a 2-foot clay cap. Some

landfills are also required to apply a 40-mil geomembrane layer above the clay cap. Revegetation is required at closure. Ground-water monitoring is required for all new and existing facilities whose plans of operation were not approved prior to February 1, 1988. For facilities constructed prior to this date, the state may require ground-water monitoring on a case-by-case basis. The current solid waste regulations allow the state to modify the requirements for landfills designed to receive “high-volume” industrial waste, specifically coal ash waste, on a case-by-case basis.

Surface impoundments must meet siting requirements and have leachate collection systems and liners, unless an exemption is granted by the state. Ground-water monitoring of surface impoundments is optional.

EPRI’s comanagement survey includes 11 active comanagement landfills in Wisconsin. All of the units have state permits and conduct ground-water monitoring. Based on their age and the controls employed, some of these units appear to have “grandfathered” out of the current requirements or to have received waivers under the high-volume waste provision. One of the landfills was opened in 1990; the rest were opened in 1988 or earlier. Three of the landfills have compacted clay liners, one has a geosynthetic liner, one has a composite liner, and one has a double liner. The remaining five are unlined. Four of the lined landfills have leachate collection systems.

## **Virginia**

Under Virginia regulations, the four large-volume CCWs are exempt from regulation as hazardous waste. Regulations applicable to management of CCWs depend on the type of management unit. All landfills managing nonhazardous solid waste must obtain a permit from the Department of Environmental Quality (DEQ). Surface impoundments are regulated under Virginia’s water control law either by the DEQ or the State Water Control Board, depending on their discharge status.

The DEQ has separate programs for industrial landfills and sanitary landfills. While sanitary landfills primarily manage household waste, they are allowed to receive nonhazardous industrial solid wastes, such as CCWs. However, because comanaged utility CCWs are most frequently handled in captive, onsite units, the discussion here focuses on the industrial landfill program. For comanaged wastes, industrial landfills must characterize the wastes entering the unit. They must provide a management plan for commingling the wastes in the permit application. Deviations from the practices outlined in the permit

require a permit modification. This requirement may restrict abrupt changes in comanagement practices in Virginia.

Industrial landfills must have leachate collection systems, run-on controls, and a liner consisting of 1 foot of compacted clay or the equivalent. They must install a cap at closure with a hydraulic conductivity less than or equal to that of the bottom liner. Industrial landfills must control fugitive dust. For fly ash and bottom ash from the combustion of fossil fuels, the regulations specifically require periodic cover or dust control measures such as surface wetting or crusting agents. Industrial landfills must conduct ground-water monitoring. In lieu of ground-water monitoring, units may install a double liner system in which the primary liner is synthetic. Landfills permitted prior to 1988 must submit a monitoring plan, but may continue operating without retrofits as long as they do not expand.

Surface impoundments that discharge directly to surface water must obtain a permit under the Virginia Pollutant Discharge Elimination System (VPDES) program, which implements the federal NPDES requirements discussed above. The VPDES program is administered by the DEQ. Impoundments that do not discharge directly, but that have the potential to discharge to waters of the state, including ground water, must obtain a Virginia Pollution Abatement (VPA) permit. VPA permits are issued by the State Water Control Board. Both programs require monitoring, but do not impose any specific design requirements. Requirements may be imposed on a case-by-case basis in individual permits.

The DEQ's solid waste regulations do not apply to surface impoundments during their operating life. Impoundments may be closed with waste in place if the closure requirements are established in the facility's VPDES or VPA permit. Otherwise, solid waste regulations require (1) removal of all liquids, wastes, and system components at closure, or (2) stabilization of remaining wastes, installation of a cover, and post-closure ground-water monitoring.

EPRI's comanagement survey includes two active landfills and two active surface impoundments in Virginia. All four units have state permits. The two landfills both opened in 1995, monitor ground water, and have geosynthetic liners and leachate collection systems. Therefore, they appear to have controls consistent with the industrial landfill program. One of the surface impoundments opened in 1989, has a compacted clay liner, and monitors ground water. The other impoundment opened in 1983, is unlined, and does not monitor ground water.

Agricultural uses of CCW are exempt from the solid waste regulations provided they meet the requirements of the Virginia Department of Agriculture and Consumer Services. Virginia has promulgated a separate regulation under which CCWs may be used in structural fills, mine reclamation, or mine refuse disposal. These projects do not require a waste management permit, but the user must notify the DEQ and provide design, operation, and closure plans. CCWs thus used must not exceed the toxicity characteristic levels for metals. Projects must incorporate fugitive dust and run-on/runoff controls. The regulations require 18 inches of cover at closure.

## **2.3 FINDINGS**

This analysis of existing regulatory controls on comanaged wastes leads to the following conclusions:

- Forty-four states, representing 96 percent of coal-fired utility generating capacity, exempt CCWs from hazardous waste regulations. The majority of CCW, therefore, is regulated under state-led RCRA Subtitle D waste management programs.
- During the last 10 years, state agencies increasingly have been granted the authority to impose environmental controls on CCW waste management. Trends in management practices suggest that states increasingly have been exercising this authority. Regulatory changes in the states studied in detail show that requirements have become more and more stringent over time.
- States vary in their approaches to regulating CCW landfills. For example, Indiana's and Pennsylvania's programs impose requirements tailored to the characteristics of the waste. North Carolina may impose requirements based on site-specific modeling. Virginia's requirements apply generically to all industrial wastes. Wisconsin may relax requirements specifically for CCW landfills. In several of the states studied, CCWs may be disposed in landfills that are "grandfathered" out of requirements imposing design requirements such as liners.
- Regulations in many of the states studied do not impose specific design requirements on surface impoundments that comanage CCWs. When these states impose requirements on impoundments, they typically do so on a case-by-case basis through their water programs.



### **3.0 NON-UTILITY COAL COMBUSTION WASTES**

EPA regulates the management of solid and hazardous waste through Subtitles C and D of the federal RCRA. Subtitle C of the RCRA establishes a “cradle-to-grave” management system for wastes that are considered hazardous because they fail tests based on their physical and chemical characteristics (i.e., toxicity, corrosivity, ignitability, and reactivity) or because they are listed as hazardous by EPA. Federal regulations establish stringent environmental and administrative controls that must be applied to management of these wastes. Non-utility CCWs are currently exempt from federal regulation as hazardous waste under Subtitle C pending this Report to Congress and the subsequent regulatory determination. Therefore, these wastes are subject to the requirements of Subtitle D of RCRA as nonhazardous solid waste.

#### **3.1 NATIONWIDE CHARACTERIZATION OF STATE REGULATIONS**

Implementation of Subtitle D is the responsibility of individual states, but nothing prevents states from imposing more stringent requirements (including hazardous waste requirements) on FFC wastes. Currently, 44 states (representing 87 percent of non-utility coal-fired generating capacity) duplicate the federal policy exempting CCWs from hazardous waste regulations. The other six states (Kentucky, Tennessee, Washington, New Jersey, Maine, and California) do not exempt CCWs from hazardous waste regulation. In these states, non-utility CCWs that fail the hazardous waste characteristic tests are subject to hazardous waste requirements. These wastes, therefore, must be managed in units that meet permitting, design, operating, corrective action, and closure standards. EPA believes that these standards, because they must be at least as stringent as the federal standards under RCRA Subtitle C, are sufficient to mitigate risks from these wastes.

Based on available characterization data, however, non-utility CCWs rarely are expected to fail the hazardous waste characteristic tests. Non-utility CCWs that do not fail the hazardous waste tests and/or are generated in the 44 states that duplicate the federal exemption generally would be subject to less stringent state requirements under Subtitle D. States generally regulate onsite waste management units that handle only non-utility CCWs using the same regulatory approaches used for utility CCW management units. They often regulate units, both onsite and offsite, that manage non-utility CCWs along with other nonhazardous industrial wastes using their standard industrial Subtitle D programs. These programs are expected to be essentially the same as those applicable to CCW-only management units. Detailed review of

regulations in several states further confirms that states regulate non-utility CCWs under the same programs as utility CCWs.

Table 3-1 shows data on state regulatory authority with respect to non-utility CCW landfills. These data show that the majority of states have the authority to require permits and to impose physical controls and monitoring requirements on non-utility landfills, at least on a case-by-case basis. The types of regulatory controls include siting controls, liners, leachate collection systems, ground-water monitoring, closure controls, daily (or other operational) cover, and fugitive dust controls. EPA believes that the use of such controls has the potential to mitigate risks, particularly ground-water pathway risks, from comanaged waste disposal. The sufficiency of this mitigation depends on the extent to which states are exercising their authority in situations in which climate, geology, site-specific conditions, and waste characteristics justify it.

**Table 3-1. State Regulatory Controls on Non-Utility CCW Landfills**

	Number of States <sup>b</sup>	Percent of States <sup>c</sup>	Percent of Capacity <sup>d</sup>
Hazardous Waste Exemption <sup>a</sup>	43	86%	80%
Permit Onsite	41	82%	82%
Permit Offsite	48	96%	96%
Siting Controls	46	96%	89%
Liner	43	86%	88%
Leachate Collection	42	84%	81%
Ground-Water Monitoring	46	92%	90%
Closure	45	90%	94%
Cover and/or Dust Controls	49	98%	96%
<sup>a</sup> Exemption from state hazardous waste regulations for CCWs <sup>b</sup> Number of states with authority to impose the indicated requirement, either by regulation or on a case-by-case basis <sup>c</sup> Percent of surveyed states with authority <sup>d</sup> Percent of surveyed generating capacity represented by states with authority Sources: CIBO, 1997; ASTSWMO, 1995; EPA, 1995; ACAA, 1996			

Data on the use of regulatory permits and environmental controls at non-utility waste management units have been collected for the Remaining Waste Report to Congress. The available data suggest that states have exercised their authority to impose controls, although perhaps to a lesser extent at non-utilities than at utilities.

### **3.2 CASE STUDIES OF STATE REGULATIONS**

To further examine state implementation of solid waste requirements on non-utility CCWs, EPA examined in greater detail the regulations applicable in five states: Indiana, Pennsylvania, Wisconsin, North Carolina, and Virginia. These five states account for more than 20 percent of coal-fired non-utility generating capacity.

#### **Indiana**

Indiana regulates non-utility CCWs the same as utility CCWs. The state classifies these and other industrial wastes as restricted and has developed a specific regulatory program for these wastes. In most cases, the chemical characteristics of restricted wastes must be analyzed using the TCLP prior to disposal. The results of this analysis dictate the type of facility in which the waste may be disposed.

Indiana regulations classify restricted waste landfills into four categories: Type I, Type II, Type III, or Type IV. Type I landfills are permitted to receive restricted wastes that leach the highest levels of constituents of concern. TCLP analysis of CCWs disposed in Type I landfills is not required. Type II and Type III landfills receive intermediate wastes that leach lower levels. Type IV landfills receive wastes that leach the lowest levels of constituents of concern. In addition, restricted waste disposal facilities are subject to design, operating, and closure requirements that vary in stringency according to their type. Table 3-2 describes the acceptable waste limitations and relevant requirements for each type of facility. Leachate collection systems are not required but may be used in some cases to relax the liner thickness requirements. Indiana's restricted waste requirements have been in effect since September, 1989; facilities that existed prior to that date may continue to operate, but any expansions at these facilities must comply with the newer regulations. Indiana regulates surface impoundments under a different set of requirements than landfills, but impoundments are expected to be rare for non-utilities.

Indiana's requirements, when applied to landfills managing non-utility CCWs, impose controls tailored to the characteristics of the individual waste streams managed. Based on available characterization data, EPA expects non-utility CCWs would be amenable for disposal in Type III landfills, with Type I or II disposal required in only a few cases. No data to examine the environmental controls employed are available for specific non-utility management units in Indiana.

**Table 3-2. Indiana Restricted Waste Disposal Facility Requirements**

Facility Type	Acceptable Waste	Design, Operating, and Closure Requirements
Landfills		
Type I	Any restricted waste	Clay liner (thickness of 10 feet or more depending on permeability of the waste), siting restrictions, fugitive dust control, daily cover, soil erosion control, ground-water monitoring, 2-foot clay cap at closure, revegetation at closure
Type II	TCLP results less than 25 times the federal MCL	Clay liner (thickness of 5 to 10 feet depending on permeability of the waste), siting restrictions, fugitive dust control, daily cover, soil erosion control, ground-water monitoring, 2-foot clay cap at closure, revegetation at closure
Type III	TCLP results less than 10 times the federal MCL	Clay liner (thickness of 3 feet), siting restrictions, fugitive dust control, weekly cover, soil erosion control, 2-foot clay cap at closure, revegetation at closure
Type IV	TCLP results at the federal MCL	Siting restrictions

## Pennsylvania

Under Pennsylvania regulations, non-utility CCWs are exempt from regulation as hazardous waste. Pennsylvania classifies these and other industrial wastes as residual, and has developed a specific regulatory program for these wastes. Generators of residual waste must submit a bi-annual report to the Department of Environmental Protection (DEP) describing the quantity and disposition of waste generated. The chemical characteristics of residual wastes must be analyzed using the TCLP prior to disposal. The results of this analysis dictate the type of facility in which the waste may be disposed.

Pennsylvania regulations classify residual waste landfills as Class I, II, or III. Class I facilities are permitted to receive residual wastes that leach the highest levels of constituents of concern, while Class II and III facilities receive wastes that leach lower levels. All classes of facility must be issued a permit by the DEP. In addition, residual waste disposal facilities are subject to design, operating, and closure requirements that vary in stringency according to their class. Table 3-3 describes the acceptable waste limitations and relevant requirements for each class of facility. Pennsylvania regulates surface impoundments similarly to landfills, but impoundments are expected to be rare for non-utilities.

The residual waste program described in Table 3-3 was promulgated on July 4, 1992. Units permitted prior to that date were subject to a transition program under which they were required to modify their operations to comply with the requirements by July 4, 1997. For these older units, DEP was allowed to waive or modify the liner and leachate collection requirements if the operator could demonstrate that the

unit had not caused unacceptable ground-water degradation or that remediation was under way to restore ground-water quality to acceptable levels.

**Table 3-3. Pennsylvania Residual Waste Disposal Facility Requirements**

Facility Type	Acceptable Waste	Design, Operating, and Closure Requirements
Landfills		
Class I	Any nonhazardous waste	Two liners (at least one composite), leachate detection system, leachate collection system, fugitive dust control, daily cover, soil erosion control, ground-water monitoring, 2-foot clay cap at closure, revegetation at closure
Class II	TCLP results less than 50 times the federal MCL	Composite liner, leachate detection system, leachate collection system, fugitive dust control, daily cover, soil erosion control, ground-water monitoring, 2-foot clay cap at closure, revegetation at closure
Class III	TCLP results less than 25 times the federal MCL	4-foot attenuating soil base or 1 foot per 4 feet of waste, fugitive dust control, daily cover, soil erosion control, ground-water monitoring, 2-foot clay cap at closure, revegetation at closure

Pennsylvania's residual waste regulations, therefore, impose controls tailored to the characteristics of the individual waste streams managed. Based on available characterization data, EPA expects non-utility CCWs would be amenable for disposal in Class III landfills, with Class II disposal required in only a few cases. No data are available for specific non-utility waste management units in Pennsylvania; however, information in the state's Residual Waste Database, which summarizes generators' bi-annual reports, suggests that the majority of non-utility CCWs in Pennsylvania are managed in offsite units. EPA expects most of these units would be Class III landfills.

In addition to disposal in landfills and surface impoundments, Pennsylvania's residual waste regulations also authorize the use of CCWs in minefills. These wastes may be used at mine sites as backfill, to improve soil productivity, to neutralize mine spoil acidity, or to create a layer of low permeability in backfilled spoil. These uses are subject to certification by the DEP. Certification requires that CCW meet the TCLP limits for disposal at a Class III landfill. The DEP may grant a contingent certification on a case-by-case basis if the waste exceeds the leachate concentration for aluminum, iron, manganese, sulfate, or zinc. Certification also requires that CCW meet pH guidelines when used as backfill or soil additive, have a minimum calcium carbonate content when used as a soil additive, and meet hydraulic conductivity limits when used as a low permeability material. Certification is reevaluated every 6 months. DEP also requires ground-water monitoring at minefills.

The regulations also authorize the use of CCWs as a soil substitute or soil additive. Such uses do not require a permit or certification, but the user must notify the DEP. The CCWs must meet pH guidelines and the user must employ runoff and erosion controls. There also are siting limitations on such agricultural uses.

## **Wisconsin**

Wisconsin regulates non-utility CCWs the same as utility CCWs. Both are exempt from regulation as hazardous wastes and are regulated as industrial solid waste under the state's solid waste management program. The state requires permits for all onsite and offsite solid waste management facilities. All landfills must meet specific design and operating requirements. Wisconsin regulates surface impoundments under a different set of requirements than landfills, but impoundments are expected to be rare for non-utilities.

New and expanded landfills for which the plan of operation was approved after July 1, 1996, must have clay or composite liners and leachate collection systems. Clay liners are required to be at least 5-feet thick. Composite liners must incorporate at least 4 feet of clay and a 60-mil geomembrane layer. All landfills are required to control fugitive dust. Landfill closure must include the application of a 2-foot clay cap. Some landfills are also required to apply a 40-mil geomembrane layer above the clay cap. Revegetation is required at closure. Ground-water monitoring is required for all new and existing facilities whose plans of operation were not approved prior to February 1, 1988. For facilities constructed prior to this date, the state may require ground-water monitoring on a case-by-case basis. The current solid waste regulations allow the state to modify the requirements for landfills designed to receive "high-volume" industrial waste, specifically coal ash waste, on a case-by-case basis.

EPA has data on 18 non-utility CCW landfills in Wisconsin. All are state-permitted and conduct ground-water monitoring. Eleven of the landfills are lined: seven with clay, one with high-density polyethylene (HDPE) and clay, one with *in-situ* natural materials, one with silt, and one with unspecified material. Eleven of the landfills have leachate collection systems. Fifteen of the 18 have either leachate collection, or a liner, or both. Data are not available on the age of the units. The unlined landfills are expected to be either older "grandfathered" units or units for which controls have been relaxed under Wisconsin's high-volume industrial waste provisions.

## **North Carolina**

In North Carolina, non-utility CCWs, like utility CCWs, are exempt from regulation as hazardous waste and are regulated as industrial solid waste. Separate regulatory programs apply to landfills and surface impoundments managing these wastes. Because surface impoundments are expected to be rare for non-utility CCWs, this discussion focuses on landfills.

Industrial solid waste landfills in North Carolina must obtain a permit from the Department of Environment, Health, and Natural Resources (DEHNR). As part of the permit process, all industrial waste landfills must demonstrate to DEHNR that their design will ensure that the state ground-water standards are not exceeded at the compliance boundary. The design criteria for demonstrating this include a composite liner, leachate collection system, and cap at closure. Alternatively, the operator may submit ground-water modeling results that demonstrate, based on hydrologic and climatic conditions and waste characteristics, that the standards will be met. Landfills operating prior to October 1, 1995 (when the state began implementing these rules), are not “grandfathered.” To continue operating after January 1, 1998, these units had to submit information to demonstrate that their original designs or proposed design changes would meet the ground-water standards. DEHNR has the authority to require design modifications if ground-water modeling methods or results are inadequate.

EPA has data on 10 non-utility CCW landfills in North Carolina. All of these are state-permitted and monitor ground water. One of the landfills is partially lined (expansion cells were lined whereas earlier cells were not). The rest are unlined. Four have leachate collection systems and two do not. It was not possible to determine whether leachate collection systems existed for the remaining four facilities. This design information was current as of late 1996. To meet the current requirements, these landfills would have had to demonstrate the adequacy of these designs, undertake design modifications, or cease operating.

DEHNR does not have specific requirements applicable to minefills. CCWs may be used for agricultural purposes under the authority of the North Carolina Department of Agriculture.

## **Virginia**

Under Virginia regulations, non-utility CCWs, like utility CCWs, are exempt from regulation as hazardous waste. Regulations applicable to management of CCWs depend on the type of management unit. All landfills managing nonhazardous solid waste must obtain a permit from the Department of Environmental

Quality (DEQ). Surface impoundments are regulated under Virginia's water control law either by the DEQ or the State Water Control Board, depending on their discharge status. However, because surface impoundments are expected to be rare for non-utilities, the discussion here focuses on landfills.

The DEQ has separate programs for industrial landfills and sanitary landfills. While sanitary landfills primarily manage household waste, they are allowed to receive nonhazardous industrial solid wastes, such as CCWs. Non-utility CCWs frequently are sent offsite for disposal. In Virginia, the offsite units could be either industrial or sanitary landfills. Onsite units would be expected to be industrial landfills.

Sanitary landfills must conduct ground-water monitoring and have leachate collection systems, run-on and runoff controls, and a composite liner. They must install a cap at closure with a hydraulic conductivity less than or equal to that of the bottom liner and conduct revegetation. Sanitary landfills must apply daily cover and control fugitive dust. The regulations specify that air pollution control residues (such as fly ash) should be incorporated into the working face of the landfill and periodically covered to prevent them from becoming airborne.

Industrial landfills must have leachate collection systems, run-on controls, and a liner consisting of 1 foot of compacted clay or the equivalent. They must install a cap at closure with a hydraulic conductivity less than or equal to that of the bottom liner. Industrial landfills must control fugitive dust. For fly ash and bottom ash from the combustion of fossil fuels, the regulations specifically require periodic cover or dust control measures such as surface wetting or crusting agents. Industrial landfills must conduct ground-water monitoring. In lieu of ground-water monitoring, units may install a double liner system in which the primary liner is synthetic. Landfills permitted prior to 1988 must submit a monitoring plan, but may continue operating without retrofits as long as they do not expand.

Data are available for eight state permitted landfills receiving non-utility CCW in Virginia. These eight are either onsite landfills or offsite captive landfills. Four of the eight landfills conduct ground-water monitoring. As state permitted facilities, monitoring would be expected at the remaining four as well. Three of the eight landfills are lined and have leachate collections systems. At least one of the other five has a leachate collection system. Information was not available on environmental controls at the other units. Specific controls expected at these units would depend on their age. At least three of the landfills were permitted prior to 1988.



Agricultural uses of CCW are exempt from the solid waste regulations provided they meet the requirements of the Virginia Department of Agriculture and Consumer Services. Virginia has promulgated a separate regulation under which CCWs may be used in structural fills, mine reclamation, or mine refuse disposal. These projects do not require a waste management permit, but the user must notify the DEQ and provide design, operation, and closure plans. CCWs thus used must not exceed the toxicity characteristic levels for metals. Projects must incorporate fugitive dust and run-on/runoff controls. The regulations require 18 inches of cover at closure.

### **3.3 FINDINGS**

This analysis of existing regulatory controls on non-utility CCWs leads to the following conclusions:

- Most states regulate non-utility CCWs the same as utility CCWs. Forty-four states, representing 87 percent of non-utility coal-fired generating capacity, exempt CCWs from hazardous waste regulations. The majority of CCW, therefore, is regulated under state-led RCRA Subtitle D waste management programs.
- The majority of states have the authority to require permits and to impose physical controls and monitoring requirements on non-utility landfills, at least on a case-by-case basis. Nationwide, current management practices suggest that states have exercised this authority, although perhaps to a lesser degree for non-utilities than for utilities. However, regulatory changes in the states studied in detail show that requirements have become increasingly stringent over time.
- States vary in their approaches to regulating non-utility landfills. For example, Indiana's and Pennsylvania's programs impose requirements tailored to the characteristics of the waste. North Carolina may impose requirements based on site-specific modeling. Virginia's requirements apply generically to all industrial wastes. Wisconsin may relax requirements specifically for CCW landfills. In several of the states studied, CCWs may be disposed of in landfills that are "grandfathered" out of requirements imposing design requirements such as liners.

## 4.0 FLUIDIZED BED COMBUSTION WASTES

Subtitle C of RCRA establishes a “cradle-to-grave” management system for wastes that are considered hazardous because they fail tests based on their physical and chemical characteristics (i.e., toxicity, corrosivity, ignitability, and reactivity) or because they are listed as hazardous by EPA. Federal regulations establish stringent environmental and administrative controls that must be applied to management of these wastes. Fluidized bed combustion (FBC) wastes are currently exempt from federal regulation as hazardous waste under Subtitle C pending this Report to Congress and the subsequent regulatory determination. Therefore, these wastes are subject to the requirements of Subtitle D of RCRA as nonhazardous solid waste.

### 4.1 NATIONWIDE CHARACTERIZATION OF STATE REGULATIONS

Implementation of Subtitle D is the responsibility of individual states, but nothing prevents states from imposing more stringent requirements (including hazardous waste requirements) on FBC wastes. FBC units are located in 30 of the 50 states. EPA characterized the waste management requirements in 27 of these 30 states using survey and other data sources<sup>1</sup>. All of these states regulate FBC wastes under the same programs as CCWs from conventional combustion processes.

Currently, 24 of the 27 states for which data are available (representing 86 percent of the surveyed FBC generating capacity and 78 percent of FBC capacity overall) duplicate the federal policy exempting CCWs (including those from coal-fired FBC) from hazardous waste regulations. The other three states (Washington, Maine, and California) do not exempt FBC wastes from hazardous waste regulation. In these states, any FBC wastes that fail the hazardous waste characteristic tests would be subject to state hazardous waste requirements and managed in units that meet permitting, design, operating, corrective action, and closure standards. EPA believes that these standards, because they must be at least as stringent as the Federal standards under RCRA Subtitle C, are sufficient to mitigate risks from these wastes.

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<sup>1</sup> Four states (Colorado, Florida, Georgia, and Pennsylvania) indicated in the CIBO survey that they impose different requirements based on the combustion technology used. EPA supplemented the survey data with specific information from its review of regulations in Pennsylvania. EPA did not collect specific data on FBC waste requirements in the other three states. These three states account for less than 10 percent of FBC electrical generating capacity.

FBC wastes, however, rarely fail the hazardous waste characteristic tests. Therefore, the majority of FBC wastes that do not fail the hazardous waste characteristic tests and/or are generated in the states that duplicate the federal exemption generally would be subject to less stringent state requirements under Subtitle D. Table 4-1 describes state regulatory authority with respect to FBC landfills in the 27 states for which data are available. These data show that the majority of states have the authority to require permits and to impose physical controls and monitoring requirements on FBC landfills, at least on a case-by-case basis. The types of regulatory controls include siting controls, liners, leachate collection systems, ground-water monitoring, closure controls, daily (or other operational) cover, and fugitive dust controls. EPA believes that the use of such controls has the potential to mitigate risks, particularly ground-water pathway risks, from FBC waste disposal. The sufficiency of this mitigation depends on the extent to which states are exercising their authority in situations in which climate, geology, site-specific conditions, and waste characteristics justify it.

**Table 4-1. Current State Regulatory Controls on FBC Landfills**

	Number of States <sup>a</sup>	Percent of States <sup>b</sup>	Percent of Capacity <sup>c</sup>
Permit Onsite	23	85%	94%
Permit Offsite	27	100%	100%
Siting Controls	25	93%	96%
Liner	23	85%	91%
Leachate Collection	23	85%	95%
Ground-Water Monitoring	25	93%	97%
Closure	25	93%	94%
Cover and/or Dust Controls	27	100%	100%
Corrective Action	22	81%	96%
<sup>a</sup> Number of states with authority to impose the indicated requirement, either by regulation or on a case-by-case basis <sup>b</sup> Percent of the 27 surveyed states with authority; for testing requirements, percent of 17 states providing information on these requirements <sup>c</sup> Percent of FBC generating capacity in the 27 surveyed states represented by states with authority Sources: CIBO, 1997; ASTSWMO, 1995; ACAA, 1996			

Data collected for the Remaining Waste Report to Congress show that most of the FBC waste landfills surveyed are subject to regulatory permits and ground-water monitoring requirements and nearly all incorporate dust suppression and run-on or runoff controls. Just more than half of those surveyed have covers and leachate collection systems and just less than half are lined. These statistics suggest that states have exercised their authority to impose control at FBC waste management units.

## **4.2 CASE STUDIES OF STATE REGULATIONS**

To further examine state implementation of solid waste requirements on FBC wastes, EPA examined in greater detail the regulations applicable in two states: Pennsylvania and California. These two states are ranked first and second in FBC generating capacity. Together, they account for more than 30 percent of total U.S. FBC electrical generating capacity.

### **Pennsylvania**

Under Pennsylvania regulations, FBC wastes are exempt from regulation as hazardous waste. Pennsylvania classifies these and other industrial wastes as residual waste, and has developed a specific regulatory program for these wastes. Generators of residual waste must submit a bi-annual report to the Department of Environmental Protection (DEP) describing the quantity and disposition of waste generated. The chemical characteristics of residual wastes must be analyzed using the TCLP prior to disposal. The results of this analysis dictate the type of facility in which the waste may be disposed.

Pennsylvania regulations classify residual waste landfills as Class I, II, or III. Class I facilities are permitted to receive residual wastes that leach the highest levels of constituents of concern, while Class II and III facilities receive wastes that leach lower levels. All classes of facility must be issued a permit by the DEP. In addition, residual waste disposal facilities are subject to design, operating, and closure requirements that vary in stringency according to their class. Table 4-2 describes the acceptable waste limitations and relevant requirements for each class of facility. Pennsylvania regulates surface impoundments similarly to landfills, but impoundments are expected to be rare for FBC facilities.

The residual waste program described in Table 4-2 was promulgated on July 4, 1992. Units permitted prior to that date were subject to a transition program under which they were required to modify their operations to comply with the requirements by July 4, 1997. For these older units, DEP was allowed to waive or modify the liner and leachate collection requirements if the operator could demonstrate that the unit had not caused unacceptable ground-water degradation or that remediation was under way to restore ground-water quality to acceptable levels.

Pennsylvania's residual waste regulations, therefore, impose controls tailored to the characteristics of the individual waste streams managed. The available leachate data for FBC wastes indicate that these wastes

**Table 4-2. Pennsylvania Residual Waste Disposal Facility Requirements**

Facility Type	Acceptable Waste	Design, Operating, and Closure Requirements
Landfills		
Class I	Any nonhazardous waste	Two liners (at least one composite), leachate detection system, leachate collection system, fugitive dust control, daily cover, soil erosion control, ground-water monitoring, 2-foot clay cap at closure, revegetation at closure
Class II	TCLP results less than 50 times the federal MCL	Composite liner, leachate detection system, leachate collection system, fugitive dust control, daily cover, soil erosion control, ground-water monitoring, 2-foot clay cap at closure, revegetation at closure
Class III	TCLP results less than 25 times the federal MCL	4-foot attenuating soil base or 1 foot per 4 feet of waste, fugitive dust control, daily cover, soil erosion control, ground-water monitoring, 2-foot clay cap at closure, revegetation at closure

rarely have leachate concentrations greater than 25 times the federal MCL. Samples from 4 percent of sites (1 of 24) showed selenium concentrations between 25 and 50 times the MCL. Samples from an additional 4 percent of sites (1 of 24) showed mercury concentrations greater than 50 times the MCL. Assuming FBC wastes in Pennsylvania display similar characteristics, these wastes would be amenable for disposal in Class III landfills, with Class I or Class II disposal required in only a few cases.

The CIBO survey includes one landfill in Pennsylvania. This unit opened in 1987 and has a state permit. It conducts ground-water monitoring, dust suppression, compaction, and covering. The landfill has run-on/runoff controls, a leachate collection system, and an *in-situ* clay liner. These controls suggest that the landfill is either a Class III landfill or a Class I or II landfill for which the liner requirements have been modified under the transition program. Thus, the one unit for which data are available appears to have environmental controls consistent with the state's regulations.

In addition to disposal in landfills and surface impoundments, Pennsylvania's residual waste regulations also authorize the use of FBC wastes in minefills. These wastes may be used at mine sites as backfill, to improve soil productivity, to neutralize mine spoil acidity, or to create a layer of low permeability in backfilled spoil. These uses are subject to certification by the DEP. Certification requires that the waste meet the TCLP limits for disposal at a Class III landfill. The DEP may grant a contingent certification on a case-by-case basis if the waste exceeds the leachate concentration for aluminum, iron, manganese, sulfate, or zinc. Certification also requires that FBC waste meet pH guidelines when used as backfill or soil additive, have a minimum calcium carbonate content when used as a soil additive, and meet hydraulic conductivity limits when used as a low permeability material. Certification is re-evaluated every 6 months.

DEP also requires ground-water monitoring at minefills. The CIBO survey identified four FBC minefills in Pennsylvania. All four monitor ground water.

The regulations also authorize the use of FBC wastes as a soil substitute or soil additive. Such uses do not require a permit or certification, but the user must notify the DEP. The wastes must meet pH guidelines and the user must employ runoff and erosion controls. There also are siting limitations on such agricultural uses.

## **California**

California regulates FBC wastes the same as FFC wastes from conventional combustion processes. None of these wastes are exempt from state hazardous waste requirements. Any FBC wastes that fail the hazardous waste characteristic tests would be subject to state hazardous waste requirements and managed in units that meet permitting, design, operating, corrective action, and closure standards. As discussed above, however, FBC wastes rarely fail the hazardous waste characteristic tests. Therefore, this discussion focuses on California's nonhazardous solid waste program.

The California Integrated Waste Management Board (CIWMB) has implemented a tiered regulatory structure for solid waste facilities. CIWMB's regulations establish the following five tiers, from the highest level of regulation to the lowest: full, standardized, registration, enforcement agency notification, and excluded. FBC wastes that are not hazardous may be disposed in "nonhazardous ash disposal/monofill facilities," which CIWMB has placed in the standardized tier. Facilities in the standardized tier are required to obtain a standardized permit and are subject to minimum operating standards. The standardized permit requirements and operating standards for nonhazardous ash disposal/monofill facilities include siting restrictions, control of windblown material, and drainage control. FBC wastes in California also may be disposed in solid waste landfills in the full permit tier. California classifies these landfills as Class I, Class II, or Class III. Information is not available on the differences in controls imposed on each class.

The CIBO survey includes five FBC landfills in California. One of these did not provide any information on environmental controls. Of the other four, one has both compacted clay and synthetic liners, one has a bedrock liner, one has an *in-situ* clay liner, and one is unlined. Two of them, including the unlined landfill, have leachate collection systems and run-on/runoff controls. The same two conduct dust suppression and

monitor ground water. All five landfills have permits, but do not specify whether these are standardized or full permits. The range of permit options available could explain the variation in environmental controls employed.

Use of FBC waste in agricultural applications or mine reclamation projects is not subject to the regulatory tiers established by CIWMB. Agricultural applications are subject to California Department of Food and Agriculture requirements. Mine reclamation projects are subject to the requirements of the Office of Mine Reclamation of the California Department of Conservation.

### **4.3 FINDINGS**

This analysis of existing regulatory controls on FBC wastes leads to the following conclusions:

- Most states regulate FBC wastes the same as CCWs from conventional combustion processes. At least 24 states, representing 78 percent of FBC generating capacity, exempt FBC wastes from hazardous waste regulations. The majority of FBC waste, therefore, is regulated under state-led RCRA Subtitle D waste management programs.
- The majority of states have the authority to require permits and to impose physical controls and monitoring requirements on FBC waste landfills, at least on a case-by-case basis. Nationwide, current management practices suggest that states have exercised this authority.
- The two states with the greatest FBC generating capacity both have industrial waste regulations that impose requirements tailored to the characteristics of the waste. California, however, allows generators of FBC wastes that do not test hazardous to utilize facilities in the standardized regulatory tier. Nonhazardous FBC wastes disposed in these facilities are subject to less stringent requirements, regardless of their characteristics.

## **5.0 OIL COMBUSTION WASTES**

EPA regulates the management of solid and hazardous waste through Subtitles C and D of the federal RCRA. Subtitle C of the RCRA establishes a “cradle-to-grave” management system for wastes that are considered hazardous because they fail tests based on their physical and chemical characteristics (i.e., toxicity, corrosivity, ignitability, and reactivity) or because they are listed as hazardous by EPA. Federal regulations establish stringent environmental and administrative controls that must be applied to management of these wastes. Oil Combustion Wastes (OCWs), whether generated at a utility or non-utility, are currently exempt from federal regulation as hazardous waste under Subtitle C pending this Report to Congress and the subsequent regulatory determination. Therefore, these wastes are currently subject to the requirements of Subtitle D of RCRA as nonhazardous solid waste.

### **5.1 NATIONWIDE CHARACTERIZATION OF STATE REGULATIONS**

Implementation of Subtitle D is the responsibility of individual states, but nothing prevents states from imposing more stringent requirements (including hazardous waste requirements) on FFC wastes. Although federal policy currently exempts OCW, like CCW, from Subtitle C regulation, state adoption of this exemption is not as extensive for OCW as for CCW. Only 26 states extend the federal exemption to OCW. These 26 states, however, represent more than 80 percent of oil-fired utility capacity. In the other states, any OCWs that fail the hazardous waste characteristic tests would be subject to state hazardous waste requirements and managed in units that meet permitting, design, operating, corrective action, and closure standards. EPA believes that these standards, because they must be at least as stringent as the federal standards under RCRA Subtitle C, are sufficient to mitigate risks from these wastes.

OCWs fail the hazardous waste characteristic tests only infrequently. Therefore, the majority of OCWs that do not fail the hazardous waste characteristic tests and/or are generated in the states that duplicate the federal exemption generally would be subject to less stringent state requirements under Subtitle D.

### **5.2 CASE STUDIES OF STATE REGULATIONS**

In the CIBO survey, 20 states (accounting for 60 percent of oil-fired utility capacity) indicated that their waste management requirements for OCWs differed from those for CCWs. To characterize these differing requirements, EPA examined solid waste regulations pertaining to OCWs in four states: Florida, New



York, Massachusetts, and Pennsylvania. These states account for more than half of the oil-fired utility electric generating capacity.

## **Florida**

Under Florida regulations, OCWs are exempt from regulation as hazardous waste and must be managed as nonhazardous solid waste. Nonhazardous solid waste landfills in Florida must be permitted by the Department of Environmental Protection (DEP). Landfills must not cause ground-water or surface water quality to exceed minimum standards outside a specified zone of discharge. To assure this, these units are subject to specific design, operating, and closure requirements. These include composite or double liners, leachate collection systems, run-on/runoff controls, ground-water monitoring, a cap including a geomembrane layer at closure, and revegetation at closure. The DEP may impose more stringent requirements as necessary due to site-specific conditions and types of waste disposed. Landfills constructed before July 6, 1993, however, are exempt from the liner, leachate collection, and run-on/runoff control requirements.

Florida's nonhazardous solid waste regulations do not impose any specific design requirements on surface impoundments managing OCW or other solid wastes. All surface impoundments require an industrial wastewater permit. Under these regulations, surface impoundments may be permitted to discharge to ground water, as long as they do not cause ground-water quality to exceed minimum standards outside a specified zone of discharge.

In addition to solid waste regulations, utilities (including oil-fired utilities) in Florida with generating capacity of 75 megawatts or greater are subject to the Power Plant Siting Act. Under the Act and its implementing regulations, electric power generating facilities must receive a certification to construct and operate from the Siting Board, which is composed of the Governor and Cabinet of Florida. The DEP is the lead agency for reviewing and evaluating Site Certification Applications. Several other state agencies participate in the review process, including the Department of Community Affairs, Public Service Commission, Game and Fresh Water Fish Commission, regional Water Management District, Regional Planning Councils, and local governments. The review process effectively creates a one-stop process in which all required permits are processed concurrently to the greatest extent possible.

The Power Plant Siting Act review process explicitly includes consideration of ash generation and the impacts of onsite solid waste management. This includes consideration of natural or manmade liners and leachate and runoff controls. The granting of certification can be subject to restrictions and requirements on any aspect of operation, including solid waste management.

Discussions with Florida DEP staff indicate that, in practice, the combination of solid waste and power plant siting regulations has not resulted in any permit requirements specifically tailored to the onsite management of oil ash. This is because the waste is produced in such “minimal quantities” that it is not specifically addressed in the permits. Of the oil-fired utilities in Florida for which specific waste management data are available, eight manage fly ash in onsite settling basins. At three facilities, these basins are HDPE lined and at one facility they are concrete lined. At the other four facilities, the settling basins are unlined and have state permits that allow discharge to ground water provided the minimum standards are met (i.e., these facilities operate percolation basins). One facility disposes of both fly ash and bottom ash in a dry, unlined ash basin. One facility sometimes stabilizes solids removed from the settling basins with cement and places them on an ash pad with an asphalt cover and vegetated sides. Thus, onsite management units in Florida incorporate varying degrees of physical controls.

Eight of the utilities send bottom ash and solids removed from the settling basins to offsite landfills when vanadium recovery is not economically feasible. All of these landfills are state-permitted solid waste facilities. As state-permitted facilities, the environmental controls required in these landfills would vary depending on their age. At a minimum, they would include ground-water monitoring and closure requirements.

## **New York**

Under New York regulations, OCWs are exempt from regulation as hazardous waste. New York’s nonhazardous solid waste regulatory program requires that all solid waste management facilities obtain a permit from the Department of Environmental Conservation (DEC). The DEC has separate programs for landfills that accept mixed solid waste (including municipal solid waste landfills) and industrial or commercial waste monofills.

Mixed solid waste landfills must have two composite liners and leachate collection systems. Units permitted prior to October 9, 1993, however, are not required to retrofit liners or leachate collection

systems, except when the facilities are expanded. All units are subject to ground-water monitoring and daily cover requirements. Lined landfills must install a composite cover at closure and conduct revegetation. Unlined landfills may have a low permeability soil or single geomembrane cover. There are no restrictions on disposing of OCWs in mixed solid waste landfills. Industrial and commercial waste monofills are subject to similar requirements as those for mixed solid waste landfills; however, the DEC may impose additional or less stringent requirements based on the volume and characteristics of the waste. In practice, single composite liners have typically been required for these monofills. New York's nonhazardous solid waste regulations do not impose any specific design requirements on surface impoundments managing OCW.

One of the oil-fired utilities in New York for which specific waste management data are available sluices fly ash and bottom ash to a concrete-lined bunker that was formerly used to hold gas. No solids are removed from this unit. The other two facilities manage fly ash in HDPE-lined settling basins. Solids from the basins and bottom ash are sent to offsite state-permitted landfills. As state-permitted facilities, the environmental controls required in these landfills would vary depending on their age.

## **Massachusetts**

OCWs are categorically exempt from Massachusetts hazardous waste regulations; however, specifically because of concerns about vanadium in oil ash, the Massachusetts Department of Environmental Protection (DEP) has developed an interim policy placing conditions on the disposal of OCWs. The policy has been in place since 1983 and applies specifically to oil ash from utilities. Coal and oil ash mixtures from utilities and OCWs from non-utilities are subject to the policy on a case-by-case basis.

Under the interim policy, disposal of oil ash is subject to written approval from the DEP. The waste may be disposed only at landfills with lined active disposal areas and leachate collection systems. It must be delivered damp to control fugitive dust and must be covered daily to prevent fugitive vanadium emissions. When landfilled according to the policy, OCWs may be handled similarly to residential refuse. They are not considered "special wastes," which, under Massachusetts regulations, are nonhazardous wastes that require particular management controls to prevent adverse impact. Massachusetts does not impose any specific design requirements on surface impoundments that manage OCWs.

Specific waste disposal data are available for two oil-fired utilities in Massachusetts. (A third facility sends its waste offsite for vanadium recovery and is, therefore, not subject to the interim policy.) Oil bottom ash at one of the facilities is managed in a pond with ash from coal-fired units at the plant. Fly ash is sent to a different series of settling basins for fly ash, with the first basin being concrete-lined and the others HDPE-lined. The facility has a state permit for discharge to ground water from the basins. Solids from the fly ash basins are placed in an onsite landfill. The landfill is state-permitted and its active cells have double HDPE liners, leak detection, and leachate collection systems. At least 1 foot of standing water is maintained in the active cells to control fugitive dust. Thus, the landfill has controls consistent with the interim policy. The second facility manages fly ash in unlined settling basins. Solids from the basins and bottom ash are sent to an offsite state-permitted landfill. As a state-permitted facility, EPA expects this landfill would be required to meet the requirements of the interim policy.

## **Pennsylvania**

Under Pennsylvania regulations, OCWs are exempt from regulation as hazardous waste. Pennsylvania classifies these and other industrial wastes as residual waste, and has developed a specific regulatory program for these wastes. Generators of residual waste must submit a bi-annual report to the Department of Environmental Protection (DEP) describing the quantity and disposition of waste generated. The chemical characteristics of residual wastes must be analyzed using the TCLP prior to disposal. The results of this analysis dictate the type of facility in which the waste may be disposed.

Pennsylvania regulations classify residual waste disposal facilities as Class I, II, or III landfills and Class I or II surface impoundments. Class I facilities are permitted to receive residual wastes that leach the highest levels of constituents of concern, while Class II and III facilities receive wastes that leach lower levels. All classes of facility must be issued a permit by the DEP. In addition, residual waste disposal facilities are subject to design, operating, and closure requirements that vary in stringency according to their class. Table 5-1 describes the acceptable waste limitations and relevant requirements for each class of facility. Storage impoundments (those that store waste for less than 1 year), which are expected to be common at oil-fired utilities, are subject to design, operating, and closure requirements that are essentially the same as those for disposal impoundments.

The residual waste program described in Table 5-1 was promulgated on July 4, 1992. Units permitted prior to that date were subject to a transition program under which they were required to modify their

operations to comply with the requirements by July 4, 1997. For these older units, DEP was allowed to waive or modify the liner and leachate collection requirements if the operator could demonstrate that the unit had not caused unacceptable ground-water degradation or that remediation was under way to restore ground-water quality to acceptable levels.

**Table 5-1. Pennsylvania Residual Waste Disposal Facility Requirements**

Facility Type	Acceptable Waste	Design, Operating, and Closure Requirements
Landfills		
Class I	Any nonhazardous waste	Two liners (at least one composite), leachate detection system, leachate collection system, fugitive dust control, daily cover, soil erosion control, ground-water monitoring, 2-foot clay cap at closure, revegetation at closure
Class II	TCLP results less than 50 times the federal MCL	Composite liner, leachate detection system, leachate collection system, fugitive dust control, daily cover, soil erosion control, ground-water monitoring, 2-foot clay cap at closure, revegetation at closure
Class III	TCLP results less than 25 times the federal MCL	4-foot attenuating soil base or 1 foot per 4 feet of waste, fugitive dust control, daily cover, soil erosion control, ground-water monitoring, 2-foot clay cap at closure, revegetation at closure
Surface Impoundments		
Class I	Any nonhazardous waste	Two liners (at least one composite), leachate detection system, leachate collection system, minimum freeboard requirements, structural integrity requirements, ground-water monitoring, 2-foot clay cap at closure, revegetation at closure
Class II	TCLP results less than 50 times the federal MCL	Composite liner, leachate detection system, leachate collection system, minimum freeboard requirements, structural integrity requirements, ground-water monitoring, 2-foot clay cap at closure, revegetation at closure

Pennsylvania's residual waste regulations, therefore, impose controls tailored to the characteristics of the individual waste streams managed. The available leachate data for OCWs indicate that these wastes sometimes have leachate concentrations greater than 25 times the federal MCL. Samples from 17 percent of sites (7 of 40) showed concentrations of at least one constituent between 25 and 50 times the MCL. Samples from an additional 22 percent of sites (9 more of the 40) showed concentrations of at least one constituent greater than 50 times the MCL. Assuming OCWs in Pennsylvania display similar characteristics, these wastes would sometimes require management in Class I or Class II units, with Class III management allowed for waste from about 60 percent of sites. No data to examine the environmental controls employed are available for specific OCW management units in Pennsylvania.

### **5.3 FINDINGS**

This analysis of existing regulatory controls on OCWs leads to the following conclusions:

- Twenty-six states, representing approximately 80 percent of oil-fired utility generating capacity, exempt OCW from hazardous waste regulations. The majority of OCW, therefore, is regulated under state-led RCRA Subtitle D waste management programs.
- States have varied in their application of solid waste management requirements to OCW landfills. For example, Pennsylvania's program imposes requirements tailored to the characteristics of the waste. Massachusetts' interim policy specifically addresses concerns over vanadium in OCWs. Other states' programs (e.g., Florida and New York) apply generically to industrial wastes. In these states, OCWs may be disposed in landfills that are "grandfathered" out of requirements imposing design requirements such as liners.
- Regulations in three of the four states studied do not impose specific design requirements on surface impoundments that are commonly used to store OCWs. Two of these states permit discharges to ground water from these units.

## 6.0 REFERENCES

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